

Site Need Statement

General Reference Information	
1 *	Need Title: Compositional Dependence of the Long Term Performance of Glass as a Low-Activity Waste Form
2 *	Need Code: RL-WT066
3 *	<p>Need Summary: The present plan for the 54 million gallons of Hanford tank waste is to retrieve the waste from the underground tanks, separate the waste into a high-level fraction (containing most of the radionuclides and hazardous materials) and into a low-activity fraction (containing most of the waste). Both fractions will be immobilized, with the immobilized high-level fraction stored until shipped to a federal geologic repository and the immobilized low-activity fraction disposed of on the Hanford Site. Because of the relatively large amount of contaminants in the Immobilized Low Activity Waste (ILAW) form, the rate of release must be slow and the rate limited for hundreds of thousands of years. Estimating such a long-term release rate from short-term experiments (even those lasting many years) requires a strong database, an understanding of the degradation process, and numerical simulation tools that combine the database and a mathematical model of the glass corrosion process.</p> <p>DOE will enter into a contract for the treatment of the tank waste. However, a particular glass composition is not expected to in the near future. As a result, the Immobilized Waste Program is performing a series of tests on representative LAW glasses to better understand how likely glasses will perform over these long periods of time. The vision for this work is given in <i>A Strategy to Conduct an Analysis of the Long-Term Performance of Low-Activity Waste Glass in a Shallow Subsurface Disposal System at Hanford</i> (PNNL-18834 or Appendix G of DOE/RL-97-69). However, there are some areas presently not being funded by EM-30. Rather the support is from EM-50, because of its greater applicability to other potential disposal actions. In particular, the database must be expanded so the affect of different glass compositions on long-term performance can be determined. An important subset of this need is to understand how glass composition impacts the rate of sodium ion-exchange in LAW glasses, which has been found to significantly affect the calculated pH in the disposal system and thus the long-term radionuclide release rate.</p>
4 *	Origination Date: FY 2000
5 *	Need Type: Technology Need
6	Operation Office: Office of River Protection (ORP)
7	Geographic Site Name: Hanford Site
8 *	Project: Disposal PBS No: RL-TW09
9 *	<p>National Priority:</p> <p>___ 1. <u>High</u> - Critical to the success of the EM program, and a solution is required to achieve the current planned cost and schedule.</p> <p>X 2. <u>Medium</u> - Provides substantial benefit to EM program projects (e.g., moderate to high life-cycle cost savings or risk reduction, increased likelihood of compliance, increased assurance to avoid schedule delays).</p> <p>___ 3. <u>Low</u> - Provides opportunities for significant, but lower cost savings or risk reduction, may reduce the uncertainty in EM program project success.</p>
10	Operations Office Priority:
Problem Description Information	
11	Operations Office Program Description: The overall purpose of the Disposal function is to provide and operate permitted facilities to disposal of immobilized low-activity waste (ILAW), store and prepare immobilized high-level waste (IHLW) for offsite shipment, and dispose of secondary waste from the tank farms and waste treatment plant (WTP), including failed melters.

12	<p>Need/Problem Description: Perform tests (PCT, PUF, SPFT, and VHT) that enable prediction of the long-term performance of low-activity waste glasses similar to those proposed glasses by the Waste Treatment Plan Contractor. The results must be suitable for use in numerical modeling performed for the Immobilized Waste Program.</p> <p>Consequences of Not Filling Need: Without these data, the ILAW disposal system approval process (involving DOE, Washington State, and the Nuclear Regulatory Commission) will require the use of quite conservative parameters, resulting in significant costs.</p> <p>Program Baseline Summary (PBS) No.: TW09</p> <p>** Work Breakdown Structure (WBS) No.: 5.04.01.03 Dispose ILAW</p> <p>** TIP No.: 2005 ILAW PA Data Package</p> <p>** This need is described in Section 9.3.3 of the Office of River Protection Preliminary Integrated Technology Plan, DOE-ORP-2001-17, Rev 0.</p>
13	<p>Functional Performance Requirements:</p> <ul style="list-style-type: none"> Create a series of glass compositions around the expected glass composition and measure the release rates of important constituents from those glasses. These measurements shall include PCT (product consistency test), PUF (pressurized unsaturated flow) tests, SPFT (single-pass flow-through) tests, and VHT (vapor hydration test). Determine the sodium ion-exchange kinetic rate constants as a function of pH, temperature, sodium, and moisture for a series of glasses. <p>Outsourcing Potential: The use of glass as a low-level waste form is under consideration for many applications where low release rates are a requirement. The ILAW program together with on-going EM-50 programs is providing the best data for non-Hanford applications of low-level glass waste forms.</p>
**	<p>Schedule Requirements: For use in the 2005 Hanford Immobilized Low-Activity Tank Waste Performance Assessment, the results of the tests are needed by April 2003.</p> <p>For use in shaping the requirements of the Phase 2 contract to treat tank waste, the results of the tests are needed by September 2008.</p>
14	<p>Definition of Solution: See functional requirements</p>
15 *	<p>Targeted Focus Area: Tanks Focus Area (TFA)</p>
16	<p>Potential Benefits: Forms the technical basis that a major part of the goal of the ORP program (disposal of immobilized tank waste) can actually be accomplished.</p>
17 *	<p>Potential Cost Savings: The possible elimination of the technetium separation processes and increases in waste loadings, either of which would save at least a billion dollars, are already identified. Reduced costs for the construction and operation of the disposal facilities would probably be an order of magnitude less, but still mounting to hundreds of millions of dollars.</p>
18 *	<p>Potential Cost Savings Narrative: The contract for the treatment of Hanford tank waste is the largest contract DOE will be involved with. The value of initial contract is about 10 billion dollars, with the succeeding contracts totaling many times more. By balancing the requirements of environmental protection and cost, DOE should be able to save at least 5% of the contract costs, mounting to billions of dollars. The possible elimination of the technetium separation processes and increases in waste loadings, either of which would save at least a billion dollars, are already identified. Reduced costs for the construction and operation of the disposal facilities would probably be an order of magnitude less, but still mounting to hundreds of millions of dollars.</p>
**	<p>Technical Basis: Because of the different compositions in tank waste, different ILAW glass formulations will be used. The <i>Hanford Immobilized Low-Activity Tank Waste Performance Assessment: 2001 Version</i> (DOE/ORP-2000-24) has demonstrated that one of the few key parameters is the release rate of contaminants from the ILAW glass. Since the release rate is known to depend strongly on waste form composition, an understanding of this dependence is necessary for successful implementation of the scope of the Office of River Protection.</p>

19	Cultural/Stakeholder Basis: Stakeholders are interested in the parameters, which drive environmental impact, rather than the parameters that are specified in a contract and only have a weak relationship to real-life performance. On-site disposal of ILAW results in the largest inventory of radioactive material to be left at the Hanford Site; thus, the waste form for this disposal is of prime concern to stakeholders.
20	Environment, Safety, and Health Basis:
21	Regulatory Drivers: As documented in the ILAW performance assessment (approved by EM-1), the long-term contaminant release rate is the driving factor in determining human health and environmental impact from the disposal of the low-activity fraction of the Hanford Site tank waste.
22 *	Milestones: Data Packages for 2005 ILAW PA (2004)
23 *	Material Streams: Immobilized low-activity waste (Hanford Site)
24	TSD System: ILAW Disposal Facility
25	Major Contaminants: Not applicable
26	Contaminated Media: Not applicable
27	Volume/Size of Contaminated Media: A majority of the 54 million gallons of Hanford tank waste will be converted to Immobilized Low Activity Waste.
28 *	Earliest Date Required: October 2001
29 *	Latest Date Required: September 2008
Baseline Technology Information	
30	Baseline Technology/Process: Conservatism will be used to bound expected behaviors. Because of the extrapolation from short-term tests on a very few glass compositions and environments and the impacts of a poor extrapolation, a significant amount of conservatism will occur. Technology Insertion Point(s): 2005 ILAW PA Data Package
31	Life-Cycle Cost Using Baseline:
32	Uncertainty on Baseline Life-Cycle Cost:
33	Completion Date Using Baseline: Post 2020
Points of Contact (POC)	
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*Element of a Site Need Statement appearing in IPABS-IS

**Element of a Site Need Statement required by CHG